The Johnson Line cargo liner M/S Santos which is equipped with Asea deck cranes, slip couplings, gearing, etc. (F 515)

ASEA JOURNAL

1961

VOLUME 34

10

3,250,000 kVA

Press the button

in the control room at the ASEA High-power Laboratory... For a brief instant power is released corresponding to half the total resources of electrical energy in Sweden – 3,250,000 kVA.

This is only one example of the resources available within the laboratories with over 800 persons at Västerås and Ludvika belonging to this large Swedish heavy electrical engineering firm.

The laboratories are on a level with the world's foremost testing establishments in the field of electrical engineering. They form the basis for the rational and, often, pioneering development and design work by means of which ASEA can successfully maintain their position among the top concerns in the world.

A running control is also carried out in the test rooms and laboratories as well as in the workshops of both purchased materials and finished products – a decisive factor in the continual striving to guarantee, and increase, the quality of ASEA products.

Research and
development work
lead to a higher
standard of living

ASEA

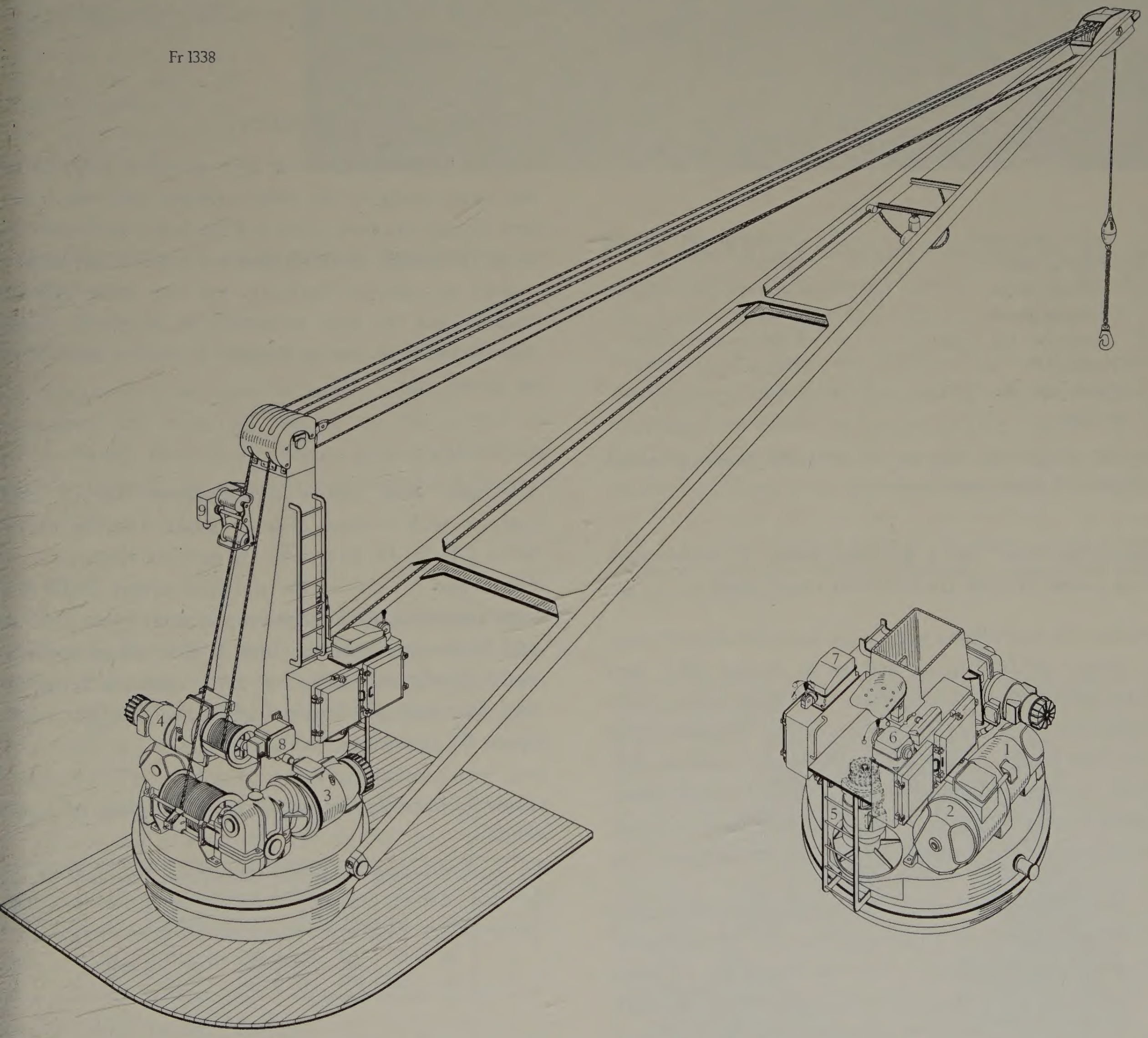
EW ELECTRIC DECK CRANE

e Sallow, Deck-machinery Sales Department, and
rl-Henrik Lindholm, Design Department for Deck Machinery, Västerås

U.D.C. 621.873.3-83:629.12
Asea Reg. 6344

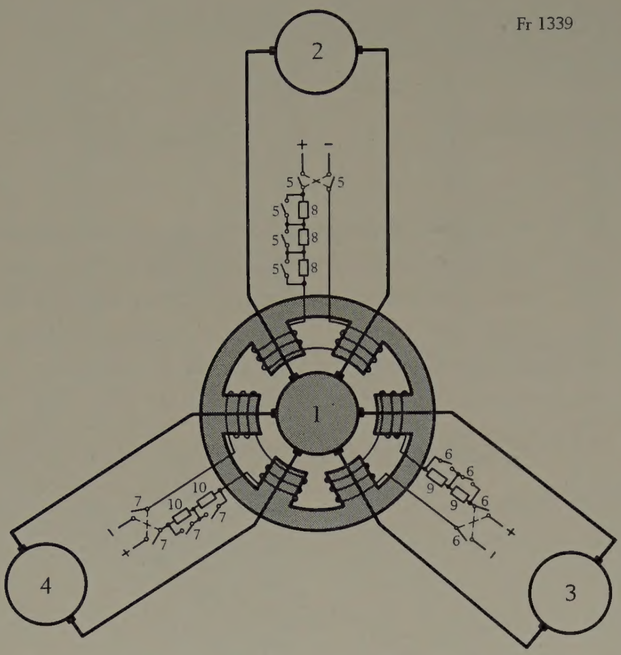
scription of the new Asea electric deck crane. Thanks its robust and compact design, both from the me-anical and electrical viewpoints, as well as to its great iability and good regulating characteristics, this deck ne helps to reduce considerably the amount of time ent by ships while in port.

As in most other branches of commerce, serious efforts have been made in the shipping world during the post-war years to rationalise its structure so as to improve the quality and capacity of marine transport. These strivings are reflected in particular in the adoption of new methods of cargo handling on board ship such as



Converter driving motor
Triple generator
3 Hoisting motor
4 Luffing motor
5 Slewing motor
6 Controller for hoisting motion
7 Controller for luffing and slewing motions
8 Limit-switch device
9 Slack-rope breaker

g. 1. The new Asea deck crane. To the left, the complete ane showing the hoisting and luffing machineries as well the rope-reeving arrangement. To the right, a sectional ew showing the crane operator's seat, slewing motor and nverter (with driving motor for 220 V, d.c.).



1	Triple generator
2	Hoisting motor
3	Luffing motor
4	Slewing motor
5	Controller for hoisting motion
6	Controller for luffing motion
7	Controller for slewing motion
8	Resistors for hoisting motion
9	Resistors for luffing motion
10	Resistors for slewing motion

Fig. 2. Elementary diagram of the triple generator which supplies all three crane motors.

the substitution, on a growing scale, of multi-motor deck cranes for the conventional cargo winches.

During the last fifteen years Asea have developed several designs of deck crane, and up to August 1961 more than 650 stationary and travelling deck cranes have been supplied to, or are on order for, shipowners all over the world. During this period the designs have been continually improved, and latest type of crane, which has now been in service for more than one year, possesses several advantages over its predecessors:

1. Both the weight and the overall dimensions have been reduced by using a compact, welded stressed-skin structure, which is set up direct on a slewing gear-ring without any internal crane post. The weight of a 5-ton crane, for example, has been reduced from 18 to 13 tons, and the platform diameter from 3.4 to 2.5 m (11 ft to 8 ft).
2. Improved accessibility to all components for inspection and replacement, due to the adoption of shaft-end gear units, directly flanged motors and a watertight Leonard converter, which does not require any extra enclosure.
3. Greatly reduced need for lubrication because of wider adoption of rolling bearings.
4. Simpler and more rugged electrical equipment sulting from the development of a special Leon converter comprising a triple generator possess current-limiting characteristics. The number of tating machines has consequently been reduced, a the control gear simplified.
5. Less risk of damage from moisture. All the v electrical parts have been moulded in moistu resistant Araldite or provided with double enclosu All the cables are of weather-resistant type w Neoprene sheath and are laid in well-protected wat tight conduits.

MECHANICAL EQUIPMENT

When comparing the new type of crane (Fig. 1) w the older designs, the most striking difference to seen is that the new crane is both lower and more co pact. The design modifications are not limited, howev merely to external features, but the most import changes are in fact reflected in improved runni characteristics as well as simplified erection and servici on board ship.

Crane types

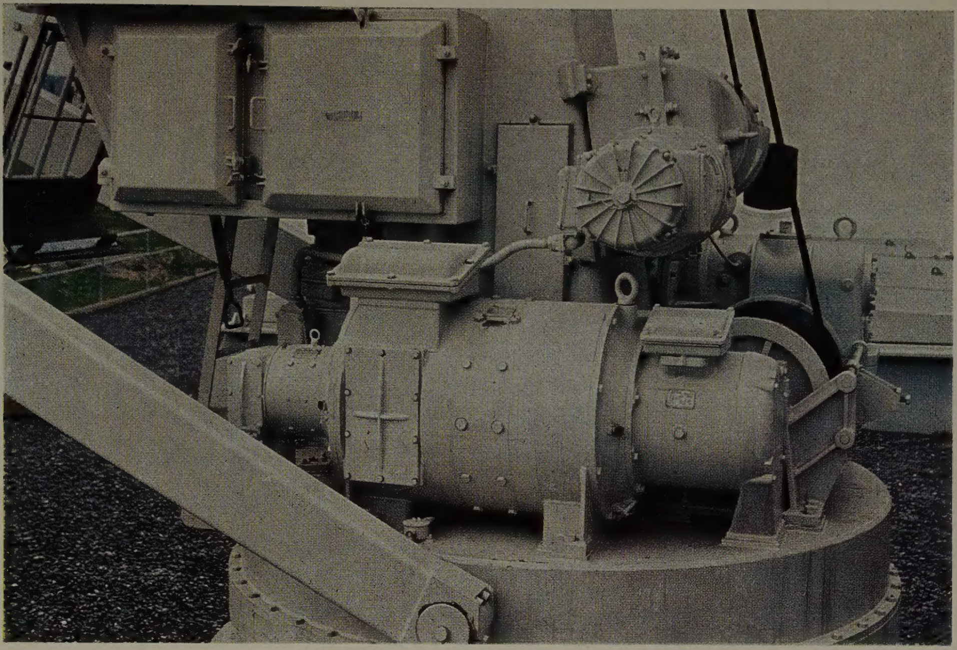
The new deck cranes are manufactured in seve variants with a max. slewing radius ranging betwe 10 m (33 ft) to 16 m (52 ft) and for loads of 3 to 5 tons and 7.5 tons in the standard design. Some of t most important data for the commonest types for 3 tc and 5 tons are listed in Table 1. The values apply tc vessel having zero trim, but the cranes are designed that they can also be used when the ship has a list up to 5° (according to DIN 120).

Table 1. Data for 3, and 5, ton deck cranes of stand design.

Type	Max. slewing radius		Min. slewing radius		Hoisting speed with load		Luffing time	Slewing speed
t	m	ft	m	ft	m/min	ft/min	s	r/m
3	14.5	48	3.5	11	60	200	20	1.5
5	16	52	4.5	15	38	125	22	1.5

Slewing gear-ring

The earlier deck crane models were carried and su ported on a rigid internal crane post, which was welc to two decks, one below the other. The location of p of the crane post in the hold was naturally a drawba but this has now been eliminated by the adoption the slewing gear-ring, which is merely bolted to upper deck by means of a flange assembly. The erect



ig. 3. The converter set, hich consists of a triple enerator and driving mo- or (for 440 V, 60 c/s) to- ether with an exciter, is t up in a watertight en- osure direct on the crane amework. (F 692)

f the new crane on board ship is consequently ex- emely simple.

ramework

he framework is designed in such a manner that the rces from the crane post and jib are transmitted via e framework direct to the slewing gear-ring and flange ssembly forming the crane foundation that is welded the deck.

ear units

ll the crane gear units have been designed with irectly-flanged motors, thus ensuring a compact unit, hich is also easier to set up and remove. The gear unit r the hoisting machinery is of the shaft-end type, hich enables the motor-gear unit to be quickly set up r removed. The luffing gear unit comprises a spur gear ith self-contained drum. Because of the reduced space vailable on the framework, the slewing gear unit has een designed as a spur gear with vertical motor (in the lace of a worm gear). This has also reduced the risk damage arising in the gear unit from the torsional fect of external forces on the crane.

heaves carried in ball bearings

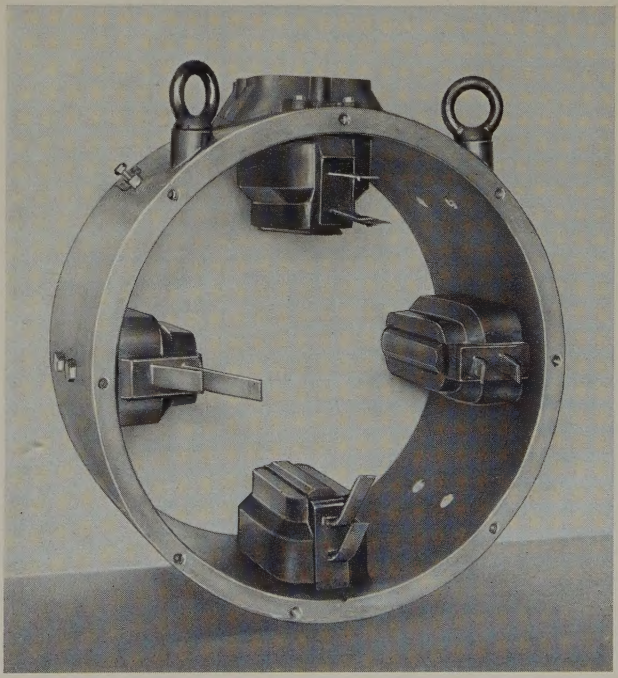
ll the sheaves are carried in ball bearings in order to nprove the efficiency of the hoisting machinery and duce the need for lubrication.

LECTRICAL EQUIPMENT

eck machinery has a vital role to play when it con- rns the limiting of the amount of time that a vessel has to spend in port. Even minor interruptions can upset its time-table, which creates irritation among the charterers and entails additional costs for the shipowner.

Experience has shown that moisture and corrosion cause the majority of faults that develop on the electrical equipment of deck machinery, which because of its location on board ship is exposed to the ravages of storms and heavy seas. Both the new Leonard converter,

Fig. 4. The commutating poles in the crane motors as well as in the triple generator are moulded in moisture-resistant Araldite. (55209)



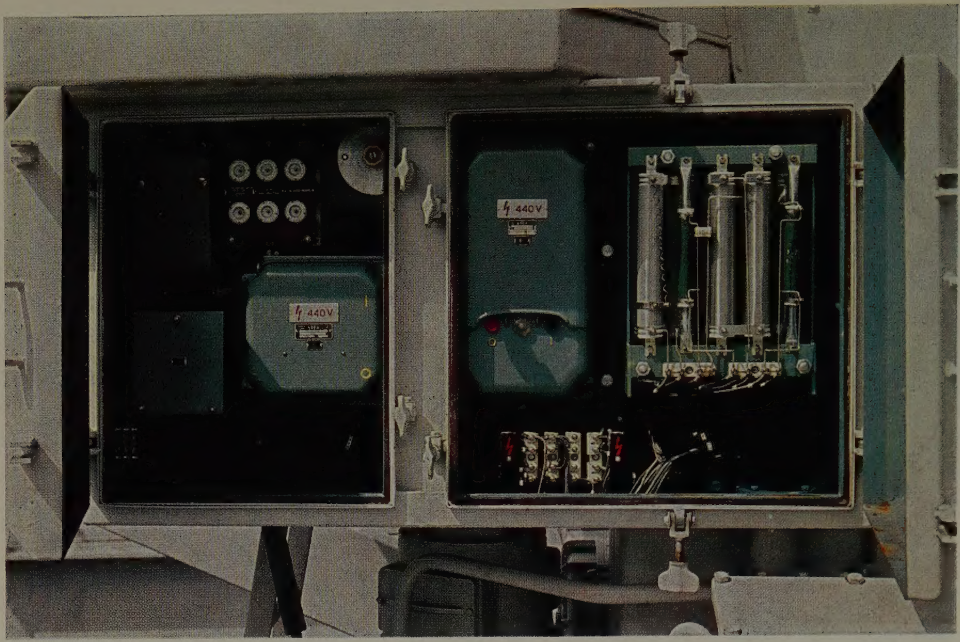


Fig. 5. Watertight contr gear box with the appa tus housed in drip-proo casings. (F 693)

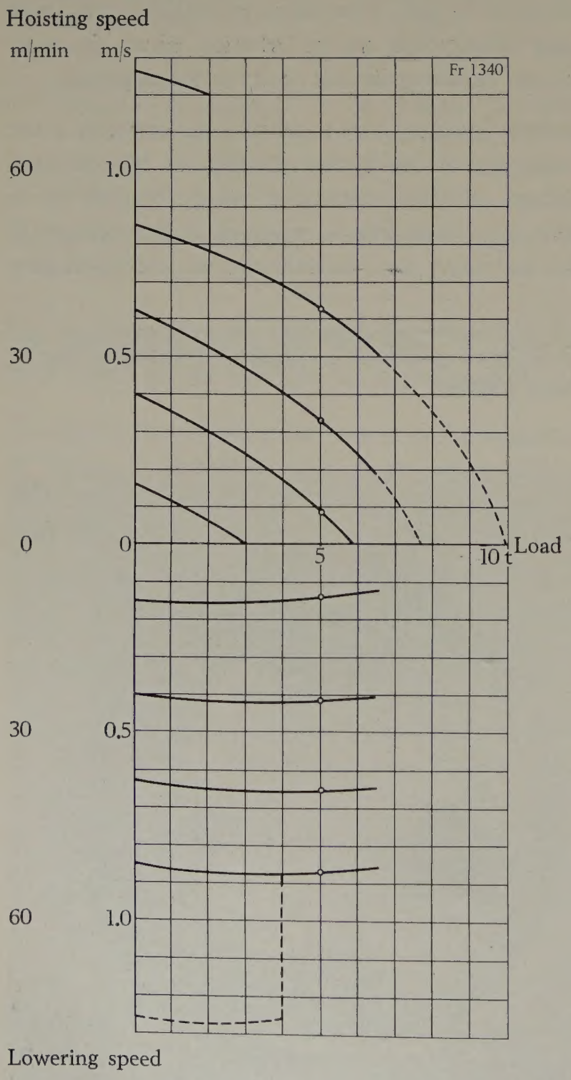


Fig. 6. The hoisting speed as a function of the load for a 5-ton deck crane.

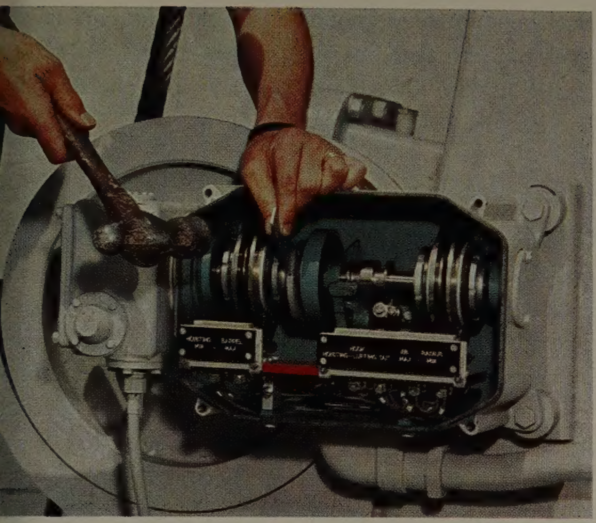
the motors and the control gear have therefore be given a specially robust and moisture-resistant desig Their service reliability will thus be high. The simp control gear and the small number of rotating machin required in the Leonard converter are also contributo factors in this respect. The good regulating chara teristics of the Leonard system and the absence of cu rent surges on the supply network are nevertheless st retained.

Leonard converter

The Leonard converter with a triple generator specia designed for the purpose [see the Asea Journal (1957):11–12, pp. 143–148] constitutes the vital pa of the new equipment. As is apparent from Fig. 2, t generator is intended to supply the motors for all thr crane motions. In comparison with a conventional set equipment, it has been possible to eliminate two gene ators or the corresponding contactor equipment. Sin these three machines are combined in this manner form a single unit, the set will be both electrically a mechanically very robust.

The triple generator is designed, in principle, as a co ventional six-pole d.c. machine, which is divided in three circuits, see Fig. 2. The main poles are provid with a differential series winding, which ensures gentle transition between the speed positions and lim the short-circuit current, in the event of the cra motors being stalled, to 2.5 times the rated curre

A conventional directly-flanged, squirrel-cage motor f 58 kW, 440 V, 60 c/s, or a d.c. motor for 55 kW, 220 depending on the nature of the supply on board,



g. 7. The setting of the limit positions in the limit-switch vice is extremely simple. (F 696)

ed as the driving motor for the triple generator. If the c. machine is used (Fig. 3), a directly-flanged con-ant-voltage exciter for 220 V, d.c., is also required.

ne complete converter set, which is of watertight de-gn, is mounted direct on the crane framework (Fig. 3) d is readily accessible for maintenance or replacement. ne cooling air for the set circulates in a closed circuit an enclosure comprising the framework and crane st, which thus serves as a sort of radiator.

s an extra form of protection against any water pene-ating inside the set, the commutating poles have been lly moulded in moisture-resistant Araldite. This has so improved the cooling of the windings, which is turally an advantage in the event of any overloading. eating resistors are also incorporated in the machines prevent the formation of condensate water.

rane motors

ne crane motors consist of watertight shunt machines rectly flanged to their associated gear units. The com-utating poles in these machines are also moulded in raldite (Fig. 4). The rotors have been reinforced in der to withstand very high speeds.

ne motors are fitted with a disc brake whose main rpose is to serve as a holding brake when the crane achineries are at a standstill. With the Leonard system, is well known, the braking itself is achieved by ectrical means, and thus the wear on the brake discs ll be reduced to a minimum. The crane motors have nsequently two completely separate braking systems, hich is an added advantage from the safety viewpoint. ne braking of the slewing motion has been made extra nooth.

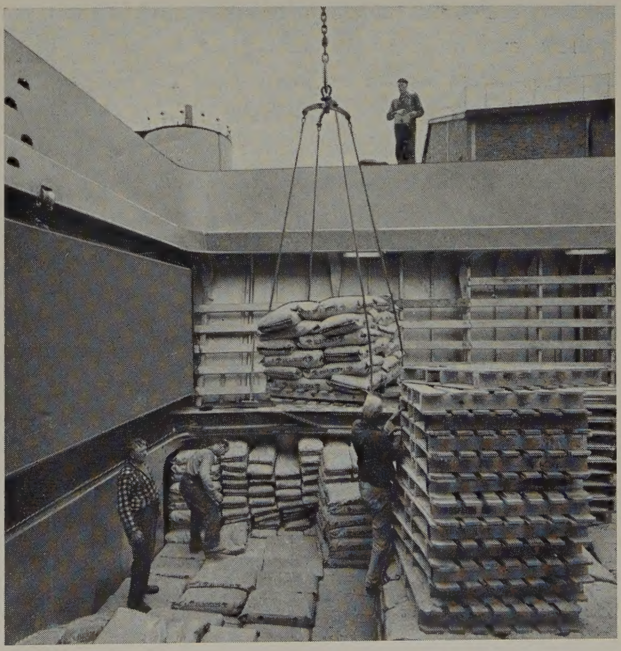
Control gear

Since the triple generator has constant-current characteristics, it has proved possible to simplify greatly the control equipment, which consists merely of a direct-on-line starter for the converter, two contactors for the limit switches and a relay for shunting up the hoisting motor to the high light-hook speed.

All the components of the control gear as well as the main isolating switch are housed in drip-proof enclosures to provide protection against any condensate water forming in the otherwise watertight control-gear boxes (Fig. 5). The control-gear resistors have been reinforced and are mounted on frames, which can be easily taken out when replacing the resistors.

The controllers, which are of the cam type, are watertight and mounted direct on the associated control-gear box. The controller for the hoisting motion has five speed notches (Fig. 6), of which the four first regulate the voltage in the hoisting branch of the triple generator, whereas the fifth shunts up the hoisting motor to a light-hook speed of twice the rated speed. This notch is automatically disconnected by the shunting relay if the load on the hook exceeds 40 per cent of the rated load. The combined luffing and slewing controller has three speed notches, with only voltage regulation, for each motion and is designed for universal control. For safety reasons the controllers are fitted with spring mechanisms which automatically return the controller lever to the neutral position when released. The controller contacts are pro-

Fig. 8. The crane may be equipped with a portable controller, which gives the crane driver a better view when loading cargo on pallets. (55614)



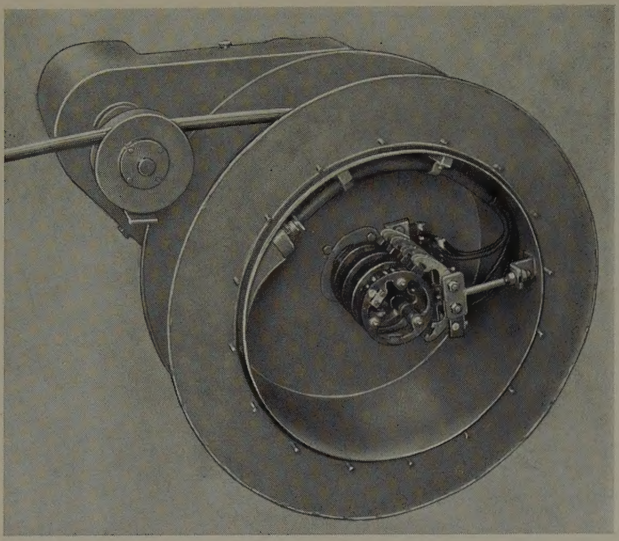


Fig. 9. The cable-reeling mechanism for a travelling deck crane. (55173)

vided with a permanent magnetic arc blow-out, which prevents the formation of arcs if the controller is set to an intermediate position.

The cables within the crane are laid entirely in water-tight conduits or cable drums, and the cables themselves are of heavy-duty type with butyl rubber insulation and a sheath of Neoprene. The cables are clearly marked to facilitate the tracing of faults and dismantling.

Limit switches

A new limit-switch device has been designed, making it possible to combine the greater part of the limit switches of the crane in one central unit. The two camshafts of this device are mechanically coupled via worm gears to the hoisting and luffing machineries. The contacts are of the same type as those used in the controllers, and interruption takes place in all the limit positions except for the slewing motion. The limit switch for the hook at the top of the crane jib is of the differential type, setting itself automatically so that it operates always at the correct distance irrespective of the angle of the jib. The limit-switch device is located in a readily accessible place, and the setting of the limit positions is very simple (Fig. 7).

The limit switch for the slewing motion is incorporated with the slip-ring gear located inside the crane post.

It has happened previously that severe damage has arisen on hoisting machineries should the hoisting motion be started with the hoisting rope slack. The new cranes have therefore been provided with a special patented slack-rope breaker mounted on the crane post. Th slack-rope breaker operates in two stages: it first sto electrically the lowering motion and then the slack ro is taken up on its jockey pulleys.

Remote operation

In the case of certain special ships carrying cargo loade on pallets, it has been found advantageous to opera remotely the crane from a portable controller (Fig. 8 The advantage of this system is that the crane operat by being mobile can obtain a better view and thus mo easily set down the cargo in the right place in the hol In addition, it is possible to do away with the norm signalling man stationed by the hatch.

The portable controller has one lever for each cran motion and, furthermore, is fitted with an emergenc stop button. The control voltage of 24 V is transmitte via a cable and slip-rings to the control-current co tactors on the crane which control the different cran motions.

TRAVELLING CRANES

The flexibility of the deck crane can be increased sti further by allowing it to travel either alongships o athwartships. The crane carriages are generally designe so that the wheels run in the hatch coaming, but car riages of the portal type also occur. The travellin cranes are nowadays always provided with rack driv to prevent the carriage from skidding in the event o the trim of the vessel being uneven.

The cranes for travelling alongships are intended fo travelling with full load and are particularly well suite for ships having large hatches. The travelling motors ar fed via a change-over device from the hoisting branc of the triple generator, and the travelling motion is thu controlled with the hoisting controller. The current i supplied via a Neoprene cable. A cable-reeling mecha nism on the crane carriage (Fig. 9) and a slack-cabl breaker prevent the cable from being damaged by th movement of the carriage.

The deck cranes for travelling athwartships are used o such vessels where the great width of the deck preven stationary cranes set up midships from effectivel serving both sides of the vessel. Travelling in this cas takes place without any load on the hook and is onl intended to move the crane to permanent working po sitions on the starboard or port side of the vessel. It i not generally necessary to install a cable-reeling me chanism, but current is supplied from a loose cable.

VALVE ACTUATORS

Gösta Lagerblad, Gear Department, Stockholm, and
Artur Jonsson, Department for Special Industrial Equipment, Västerås

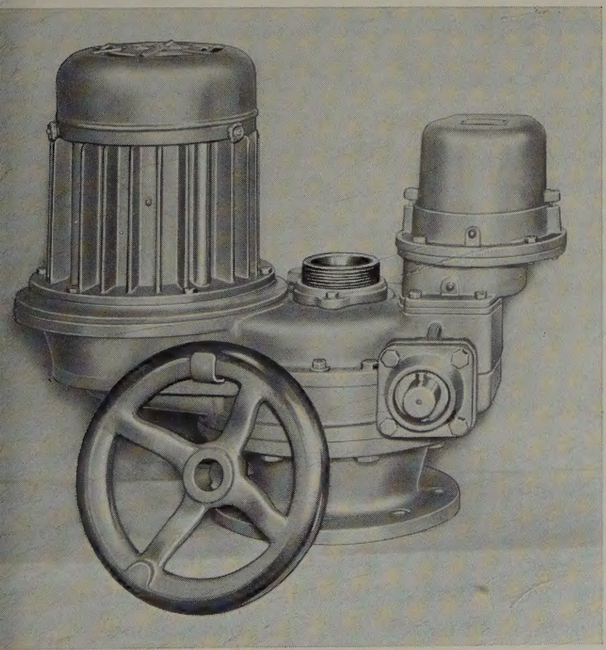
U.D.C. 621.316.71–38
Asea Reg. 5275

Great demands are nowadays made on modern valve ctuators. The new Asea valve actuator, for which atents have been applied, is a compact, easily operated nit, which satisfies all modern requirements. Since the alve actuator is controlled electrically and its operation s dependent both on the stroke of the valve stem and n the torque, it can be easily adapted to meet different equirements imposed by the most widely varying types f valve.

OLDER VALVE ACTUATORS

or many years Asea have been manufacturing actuators or industrial valves. These have been of two different ypes, a large unit (type BTA) for a torque of between 20 and 5 kgm, and a small unit (type BTC) for a orque of between 1 and 5 kgm. Both these types of alve actuator have proved to be very reliable and have von the confidence of our customers over a long period f years. Since, however, the valve manufacturers in ecent years have expressed a need for new forms of peration with the valve actuator, the larger units Fig. 1) have been replaced by a new type (Fig. 2), ased on entirely new design principles.

ig. 1. Valve actuator of older design. (43096)



THE NEW VALVE ACTUATORS

The design of the new valve actuators incorporates the latest advances within the field of gear cutting and this has led to a considerable reduction in the weight of the new actuators in comparison with the old ones. This factor is of great importance, since the piping carrying the valve actuators is nowadays manufactured of relatively thin material.

Five different sizes of valve actuator covering a torque range of 5 to 60 kgm were available previously. This torque range is now covered by three sizes of the new type, which has resulted both in larger series and a cheaper product. The torque ranges of the old and new valve actuators are listed in Table 1, which also shows that the differences in weight for the same torques are considerable.

The gear-wheels of the gear unit used in the new valve actuator are cut from case-hardening or toughened alloy steel. The steel shafts have ground bearing seats and are carried in SKF rolling bearings. The gear unit is grease-lubricated, and the valve actuator can consequently be mounted in any position.

The new requirements

Previously, the chief requirement placed on the valve actuator was that it should yield a greater opening force than closing force. This was achieved by various mechanical means, which have operated satisfactorily. Considerably greater demands are nowadays made on a modern actuator, and these can be summarised as follows:

1. Remote operation must take place in such a manner that the position of the valve can be observed con-

Table 1. Torque range and weight of the old and new valve actuators.

Old actuator type	Torque range kgm	Weight kg	New actuator type	Torque range kgm	Weight kg
BTA 32	33–48	190	UAKD 247	23–60	78
BTA 18 BTA 12	9.1–23	125 115	UAKD 243	13–25	55
BTA 7.5 BTA 5	2.3–8.1	75 70	UAKD 241	5–15	45

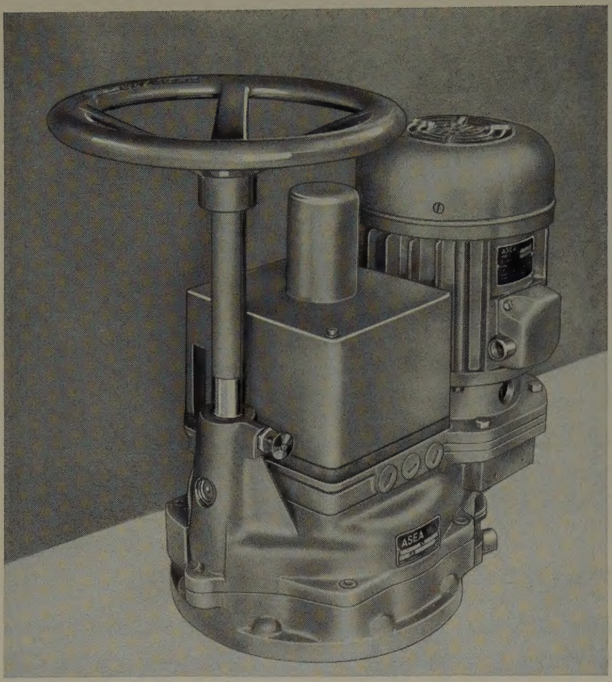


Fig. 2. Valve actuator of the new type for a maximum torque of 60 kgm. It is of very compact design and is built together of standard components which can be easily taken apart. The standard motor is bolted to the gear unit and is thus easy to remove. Power is transmitted via a self-adjusting electromagnetic slip coupling with stationary coil. The limit-switch device is built as an integral unit and can be easily removed. The gear unit is lubricated with grease and can thus be set up in any position. (53965)

tinuously. If an operation is to be stopped due to any disturbance in the valve, a signal must be given.

2. Interruption of the operation in either direction dependent on the stroke of the valve stem must be possible.
3. Interruption in either direction dependent on the torque must be possible.
4. The valve actuator must be capable of yielding a certain torque in the one direction and a larger or smaller torque in the other direction. Occasionally, it must be possible to alter automatically the torque from one value to another while the actuator is being run in the same direction.
5. In the event of a power failure, it must be possible to operate the actuator manually by means of a handwheel, which, when closing the valve, is turned clockwise.
6. When operating the valve by hand, the supply to the motor should be interrupted in the case of large torques, and the motor disengaged.
7. Since the valve actuator is often set up in damp localities, a hose-proof enclosure is essential.

When designing the new valve actuator, it soon becam apparent that it would prove impossible to achieve thes aims by purely mechanical means as in the case of th earlier types. Electrical control of the actuator woul have to be selected instead. Fig. 3 shows a cross-sectio of the new valve actuator, and Fig. 4 the associate apparatus box.

The main object of the development work has been t build up the valve actuator of simple standard unit which can easily be replaced if required. The drivin motor in the standard actuator consists of a conventiona squirrel-cage machine (type MBB, form R, disp. 214 B) The motors used are of the 4, 6, or 8, pole type, de pending on the output speed and torque required.

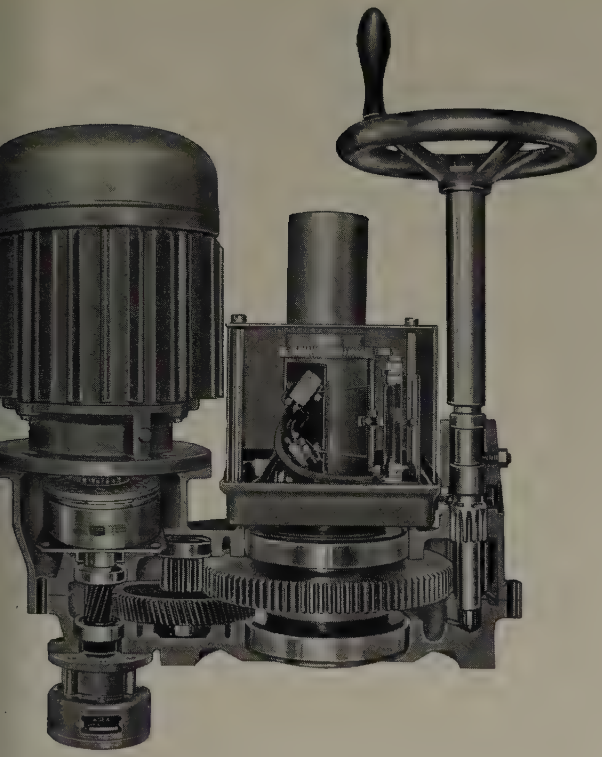
When the valve reaches one or other of its end po sitions, the actuator must stop very rapidly. In order t prevent the inertia of the rotor from influencing in an way the magnitude of the closing torque, the rotor ha to be separated from the output shaft by a couplin which would absorb the kinetic energy of the roto without any increase in torque. In the case of high speed motors the kinetic energy of the rotor produce a torque that is several times the maximum torque o the motor. If the motor is rigidly coupled to the valve the closing torque will then always correspond to th torque caused by the kinetic energy of the rotor, irre spective of the torque at which the motor is switched off

This problem has been solved in the new valve actuator by means of an electromagnetic slip coupling, lackin any slip-rings, with a stationary coil, which signifies tha the coupling has a very low inertia. The transmitte torque can be adjusted on a series-resistor in the appa ratus box. The output shaft of the coupling is connecte to a two-stage spur gear unit, which is generally flange direct to the valve bonnet.

As is apparent from Fig. 3, a speed relay is secured t the high-speed shaft of the gear unit for the purpos of disengaging the motor when the gear unit stops a a result of the coupling slipping. This speed relay is o standard type (TVRB 18) and has one contact for eac direction of rotation which is closed when the shaf rotates and open when the shaft is at a standstill. Durin starting the speed relay is by-passed.

Limit switches and indicating device

The valve actuator also incorporates a limit-switch de vice provided with two two-way limit switches for eac end position and a potentiometer resistor to provid continuous position indication if required. The desire number of turns of the valve stem between the limi positions can be easily set with a screwdriver.



g. 3. *Valve actuator for a torque of 60 kgm showing a oss-section of the gear housing and the limit-switch device. ıst below the motor can be seen the electromagnetic slip upling and, furthest down, beneath the gear housing, the eed relay, which is coupled to an extension of the high-eed pinion. In the limit-switch device, which is built up ound the main shaft of the actuator, can be seen, to the ght, the potentiometer resistor and, to the left, the limit vitches, whose operation depends on the stroke of the lve stem, with their operating arms. The handwheel is own in the disengaged position. (53998)*

he limits within which the above setting can be made the standard and special units are shown in Table 2. he larger number of turns with the special actuators achieved by altering the gear ratio between the main aft and the limit-switch device.

or the standard design of valve with rising stem the ngth of stroke of the stem is about 400 mm (15.7 in.), hich is quite adequate for the majority of cases. If the roke is longer and more room is required, this can sily be achieved by lengthening the shaft of the hand-heel and the protective sleeve for the stem.

ne limit-switch device also contains an interlocking ntact, which interrupts the control current to the uipment and also to the magnet coil winding of the p coupling as soon as the handwheel has been in-rted. During manual operation the motor is thus ways disconnected from the supply and fully disen-ged from the valve. The smallest type of valve actu-or, however, does not have this interlocking contact.

Table 2. Range of turns for the limit switch for the valve actuators.

Valve actuator type	Limit switch	
	Standard design	Special design
UAKD 241	10–45 turns	25–100 turns
UAKD 243	15–65 turns	50–210 turns
UAKD 247	20–80 turns	55–230 turns

In this case, because of the low torque, the handwheel for manual operation is keyed direct to the stem sleeve, which thus means that it always rotates with the stem. As an additional safety measure, the handwheel is shaped as a disc without any spokes.

The limit-switch device incorporates, finally, a mechanical position indicator, which is visible through a window on the cover. A heating resistor may be connected up, if required, to prevent the formation of condensate water.

The various functions of the limit-switch device are illustrated by means of the circuit diagram in Fig. 6.

Separate apparatus box

A separate apparatus box (Fig. 4) accommodates all the necessary apparatus for operation, indication and pro-

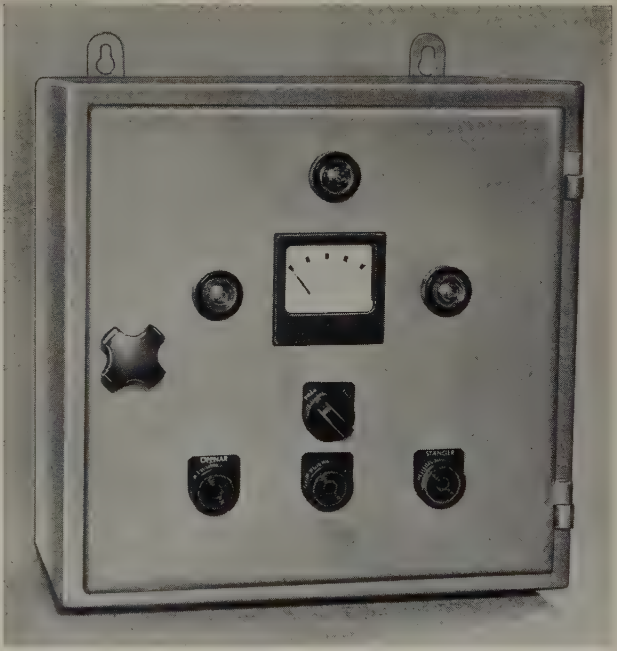


Fig. 4. Apparatus box for the control and indication of the valve actuator. The illustration shows the pushbuttons "Open", "Close" and "Stop", the switch for connecting up the equipment to the supply, lamps for the indication of fully open or fully closed valve, indicating lamp for faults, and instrument for the continuous position indication of the valve. The interior of the box houses contactors and thermal overload relay for the motor, transformer, rectifier and series-resistor for the electromagnetic slip coupling, and auxiliary relays for interlocking, etc. (53986)

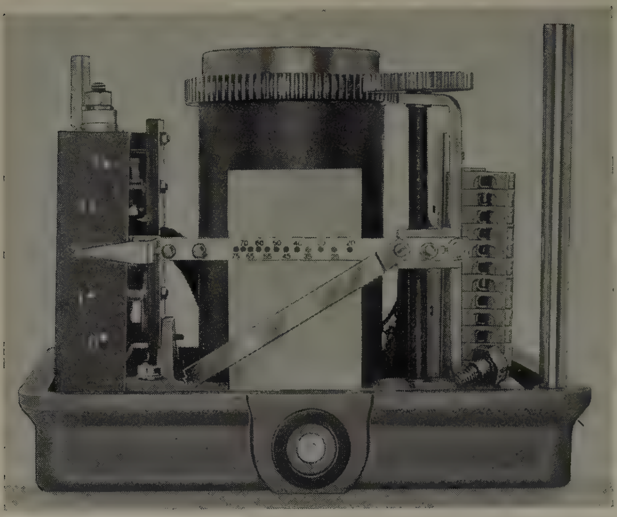


Fig. 5. The limit-switch device for the valve actuator. The operating arm of the limit-switch device is actuated by a nut which runs up and down a finely threaded spindle driven via a gear-wheel from the main shaft of the actuator. The setting of the number of turns for a complete operation is made on the pin on which the operating arm is pivoted. This pin in inserted in the hole corresponding to the number of turns of the associated valve. The operating arm is fitted with a pointer which indicates directly on the scale the position of the valve. It is also fitted with a carrier for the moving terminal of the potentiometer resistor and for the operation of the limit switches whose interruption is dependent on the stroke of the valve stem (hidden behind the scale). (53992)

tection. The standard equipment includes contactors, a thermal overload relay for the motor, a rectifier for feeding the electromagnetic slip coupling and a series-resistor for this, pushbuttons for operation, indicating lamps for indication of the valve position as well as any faults, and, if required, an instrument for the continuous position indication of the valve.

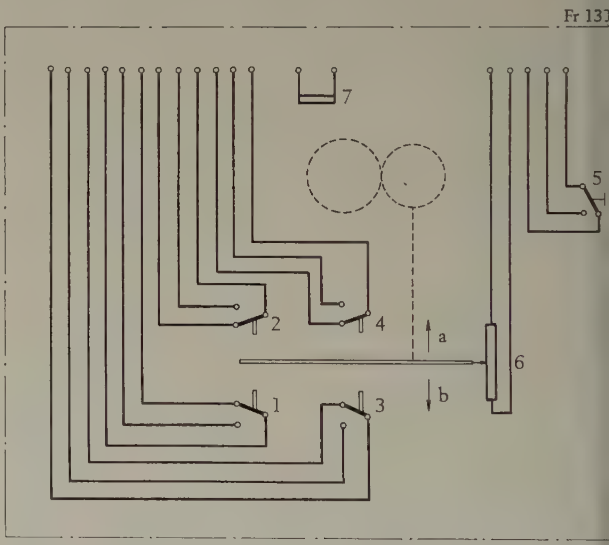
Example of working cycle

When using the equipment based on the circuit diagram shown in Fig. 7, the following working cycle may be obtained.

When the pushbutton "Close" is pressed, the valve actuator is started up and operates the valve so that it closes. When the valve reaches its lower limit position, the torque developed by the actuator increases until the coupling slips. This causes the gear unit to stop and consequently also the speed relay, which interrupts the current to the motor. By this means "torque-dependent" interruption in the lower position has been achieved, which implies that the valve in the closed position will always seal against the mating body seat with a certain pressure. When the actuator has stopped in this manner, it is interlocked, which means that it can only be started up again in the opposite direction. The interlock is

released by operating the actuator in the opposite c
rection. If, on the other hand, the movement is inte
rupted by pressing the "Stop"-button, the interlock w
not function. In order to make quite certain that t
valve does not jam in its lower position, the actuat
must develop a higher torque when opening the valv
The torque required to slacken the valve disc from i
seat is normally about 150 per cent of the closing torqu
This is achieved by increasing the excitation of t
electromagnetic slip coupling, which is done when pre
sing the "Open"-button.

With certain valves it is also desirable to seal the val
in the open position, i.e., "resealing", where the upp
part of the valve disc is shaped as a cone and sea
against the upper part of the valve body. This signifi
that the interruption of the actuator also in its upp
position must be dependent on the torque. Owing
the small dimensions of the upper part of the valv
body, however, it is desirable that this "resealing" torqu
should be less than the normal torque, for examp
about 60 per cent. The corresponding alteration of t
excitation of the slip coupling is preferably carried o
with the aid of a contact located in the limit switc
This contact makes the reconnection just before t



1 Limit switch for closed valve
2 Limit switch for open valve
3 Signal contact for closed valve
4 Signal contact for open valve
5 Automatic interlockin contact for motor du ing manual operation
6 Potentiometer
7 Heating resistor

a Opens
b Closes

Fig. 6. Circuit diagram for the limit-switch device f
the valve actuator types UAKD 243 and 247. The diagra
shows the position of the contact when the valve cone
located in an intermediate position during motor operatio
Contact 3 closes before contact 1 opens, and contact 4 clos
before contact 2 opens. The contacts 3 and 4 are intende
for indicating the end positions.

lve has reached the upper position. Resealing of a lve is considered to be very advantageous by valve anufacturers, since this both relieves the stuffing box the valve body of any load and enables a stuffing box be replaced without there being any risk of leakage rough it. This is of great importance, particularly ıen the piping contains any form of "dangerous" luid. In the examples mentioned here, the valve oper- es with torque-dependent interruption in both di- ctions.

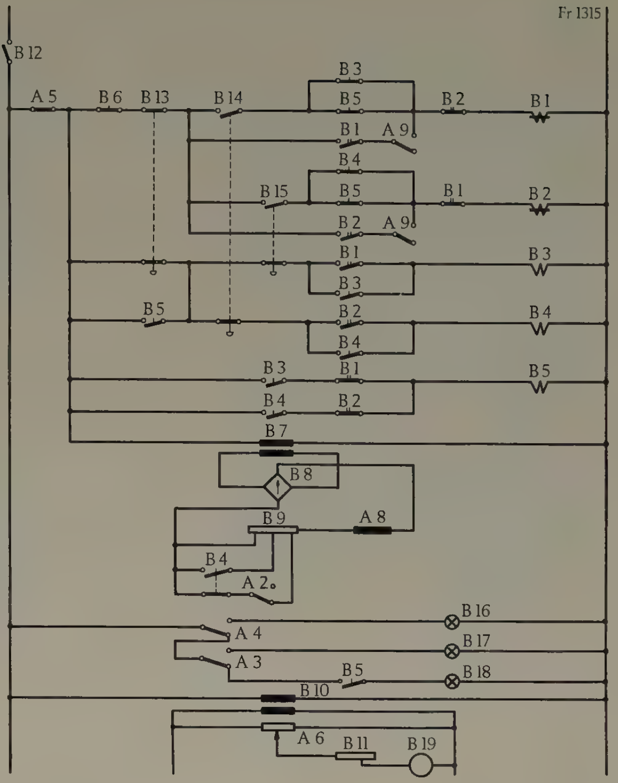
for any reason a foreign body should enter the valve using it to jam in an intermediate position, the valve tuator will stop because of torque interruption. Should ch a stop take place, a warning lamp lights up and dicates that a disturbance has occurred. The valve tuator is then interlocked in the same manner as for torque-dependent interruption in the lower limit po- ion, and thus cannot be made to operate in the same rection. When using other types of valve, it may not necessary to use such a comprehensive set of control uipment as incorporated in the standard Asea appa- tus box. In such cases it is possible to build up the cessary equipment with standard units so as to obtain e desired functions.

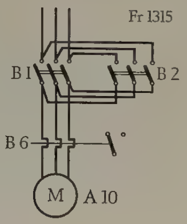
lternative methods of operation

the valve is not designed for "resealing" in the open sition, a limit switch may be used for interruption pendent on the stroke of the valve stem so that the lve stops in the desired position. Naturally, it is also ssible to arrange for the valve to stop, dependent on e stroke, in both directions.

r regulation purposes the valve actuator can be oper- ed without any hindrance by means of the "Open", lose", and "Stop", buttons, thereby regulating the w through the valve.

stead of operating the valve by means of pushbuttons, tomatic control can be arranged by means of liquid vel controllers, flow meters, etc.





A	Valve actuator type UAKD
A2	Limit switch for open valve
A3	Signal contact for closed valve
A4	Signal contact for open valve
A5	Interlocking contact for manual operation (open when the hand-wheel is inserted)
A6	Potentiometer
A8	Electromagnetic slip coupling
A9	Speed relay
A10	Motor

B	Apparatus box
B1	Contactor for opening
B2	Contactor for closing
B3	Auxiliary relay for interlocking
B4	Auxiliary relay for interlocking
B5	Auxiliary relay for interlocking
B6	Thermal overload relay
B7	Transformer
B8	Rectifier
B9	Series-resistor for coupling
B10	Transformer
B11	Series-resistor
B12	Switch
B13	Pushbutton: Stop
B14	Pushbutton: Open
B15	Pushbutton: Close
B16	Signal lamp for open valve
B17	Signal lamp for closed valve
B18	Signal lamp for fault in valve
B19	Indicating instrument

g. 7. Example of circuit diagram for the control and indi- ting equipment for a valve actuator. By pressing the lose"-button B15, the valve actuator is started in the sing direction by contactor B2. The contact on the speed ay A9 is by-passed during starting by the pushbutton. hen this is released, contactor B2 is kept energised across contact on the speed relay, which closes as soon as the uator starts. The contactor B4, which is energised at the ne time as B2, connects in a part of resistor B9 in series th the magnet coil winding on the slip coupling A8, thus ting the desired closing torque on the coupling. When the lve has reached the closed position, the torque increases, coupling slips and the speed relay stops, thus causing contact to disconnect contactor B2 and the motor to stop. this position the contactors B4 and B5 are both energised and prevent contactor B2 from being energised again by the pushbutton B15. As soon as the "Open" button B14 is pressed, this interlock is released. Operation in the opening direction takes place in an analogous manner, the coupling now being energised for the opening torque until the limit switch A2 switches over to the "resealing" torque just before the valve has reached its upper position. The fault-indication lamp B18 shines when the actuator has been stopped owing to an excessive torque without the valve having reached either of its end positions.

THE REACTION CHAMBER – A NEW BREAKING FEATURE FOR HIGH-VOLTAGE CIRCUIT-BREAKERS

Gunnar Öhman, High-voltage Switchgear Design Department, Ludvika

U.D.C. 621.316.542.027.3.064
Asea Reg. 5445

Description of the reaction chamber, a simple but effective interrupting element for oil-minimum circuit-breakers. It is capable of interrupting very high currents within the voltage range of 3–24 kV and, because of the rapid expulsion of the arc gases, is very suitable for high-speed auto-reclosing. The dimensions of the chamber are small and the compressive stresses low.

The energy given off by the arc in circuit-breakers utilising oil as the arc-extinguishing medium brings about a violent vaporisation of the oil along the path of the arc, and consequently a pronounced rise in pressure. In such types of circuit-breaker it is generally usual to adopt self-acting interrupting elements, which utilise in one way or another this pressure to force a flow of de-ionising gas or oil against, or along, the arc. A very simple and effective interrupting element of this kind has been used for some years in certain Asea mediu voltage circuit-breakers. This extinguishing chamber h been given the name *reaction chamber* because of mode of operation.

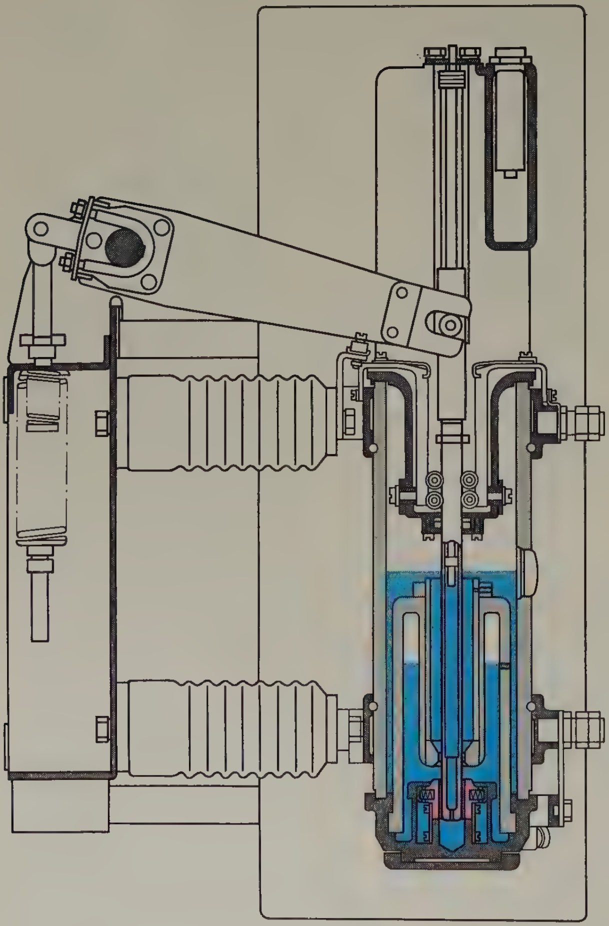


Fig. 1. Cross-section of an Asea oil-minimum circuit-breaker type HKH 12/630 for 10/12 kV, 630 A, 400 MVA. (Fr 1266)

DESIGN

The basic design of the reaction chamber is illustrat in Fig. 2, which shows the lower part of a breaker pc with oil container, extinguishing chamber and contac The chamber has a cylindrical outer shell which at tl top is bent inwards and downwards so as to form annular air pocket. The central orifice inside this sealed by a cup-shaped cover of insulating material ar with an opening for the moving contact. The bottom the chamber consists of a metal flange which incorporat the fixed contact. The chamber is in communicatic with the surrounding oil container by means of a sm hole in the cylinder wall. The position of this hole dete mines the oil level in the chamber and the volume the enclosed air above this level. Otherwise, the chamb can be considered as being fully sealed when the circu breaker is closed.

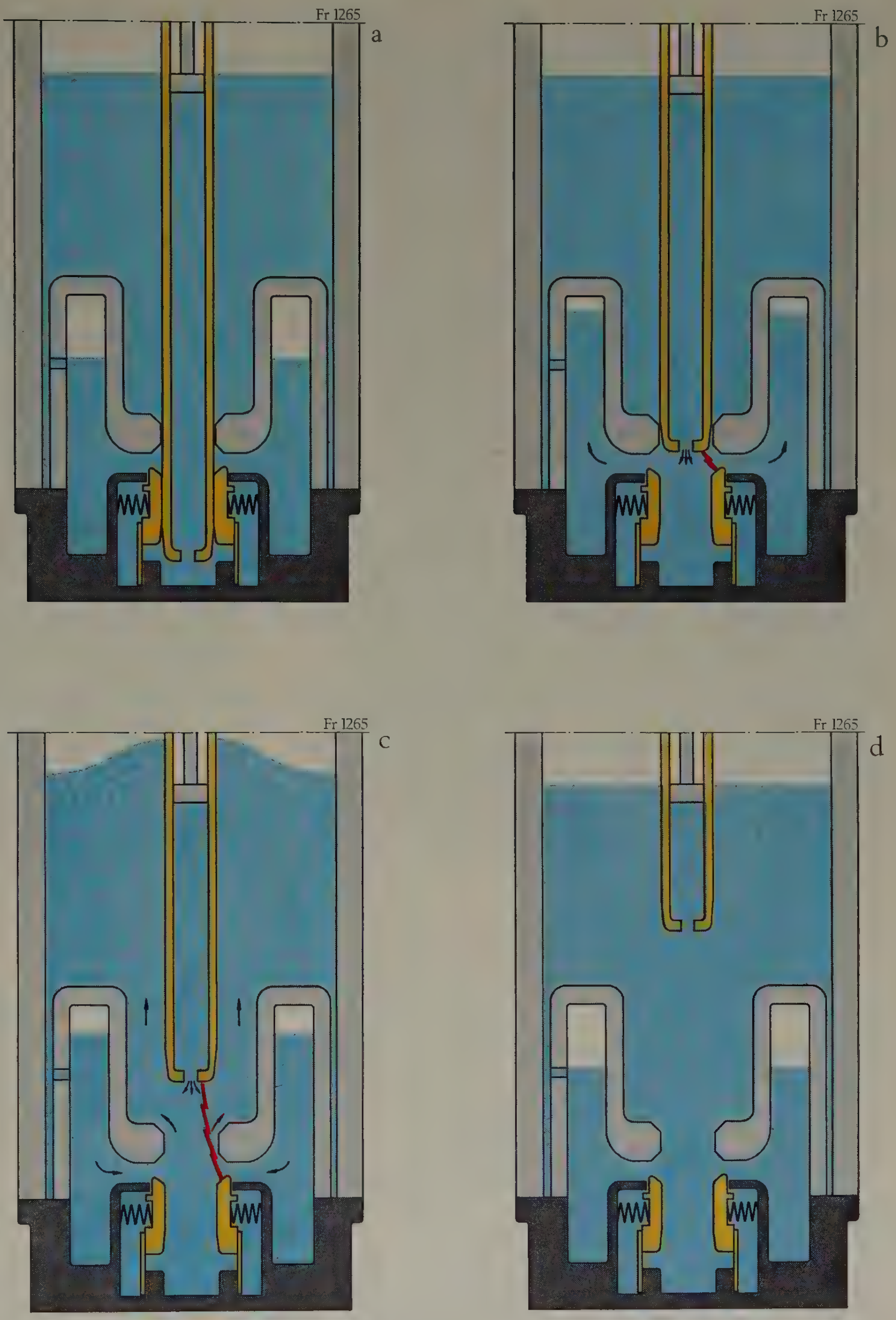
The moving contact is of the plug type. It has a built- oil pump, which is intended partly to counteract tl accelerating effect of the chamber pressure on the co tact and partly, in the case of low breaking current to supply additional oil for quenching the arc throug a duct in the tip of the plug. The fixed contact is of tl socket type with spring-loaded contact segments. I addition, there is an annular arcing contact above tl segments which is made entirely of contact metal, wher as the plug contact and the segments are clad with th metal only at those parts where they can be attacke by the arc.

MODE OF OPERATION

The reaction chamber operates in the following mann when opening, see Fig. 2.

a) The circuit-breaker is in the closed position (Fig. 2a

b) The circuit-breaker opens (Fig. 2b). An arc is draw between the arcing contact and the tip of the plug co tact, resulting in a violent vaporisation of the oil. Tl gases are compressed in the sealed chamber, while tl air cushion is compressed at the same time and leav sufficient space for the gases so that the compressi



The circuit-breaker in the closed position
The circuit-breaker opens and an arc is drawn between the arcing contact and the tip of the plug contact
The tip of the plug contact has passed the opening in the cover of the chamber and the arc is extinguished at the next current zero by the escaping gases and the oil
The interruption is completed

g. 2. Mode of operation the reaction chamber.

esses on the chamber are reduced to a reasonable lue.

The tip of the plug contact has passed the opening in e cover of the chamber (Fig. 2c). When the current ave approaches zero, the pressure drops very rapidly the chamber orifice. The arc gases can then flow out eely into the expansion chamber at the top of the eaker pole, and a violent flow of gas is obtained along e arc path, which is rapidly de-ionised. At the same ne, the air in the air pocket expands and forces the oil ter the arc gases through the chamber orifice. The di- ectric strength between the contacts is quickly restored so that restriking of the arc is prevented. Metallic and carbon particles are flushed away at the same time from the vital parts of the chamber.

During the interruption the pump device in the plug contact starts to operate. At high breaking currents its speed-damping effect on the movement of the contact is of great importance. The arc should not be drawn unnecessarily far outside the opening for the contact before a suitable current zero for the arc extinction occurs. The pressure rise in the breaker pole is thus limited to a reasonable value, since the arc energy is directly proportional to the length of the arc.

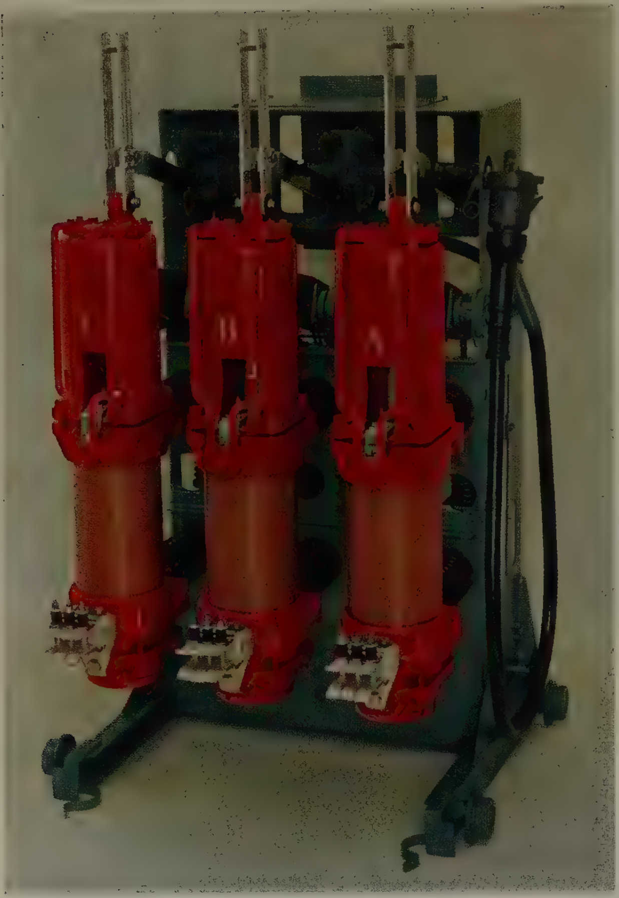


Fig. 3. Oil-minimum circuit-breaker of type HKNH 12/630 for 10/12 kV, 630 A, 400 MVA. The circuit-breakers is of the truck type and is intended for mounting in the Asea metal-clad switchgear of type VHB. (F 720)

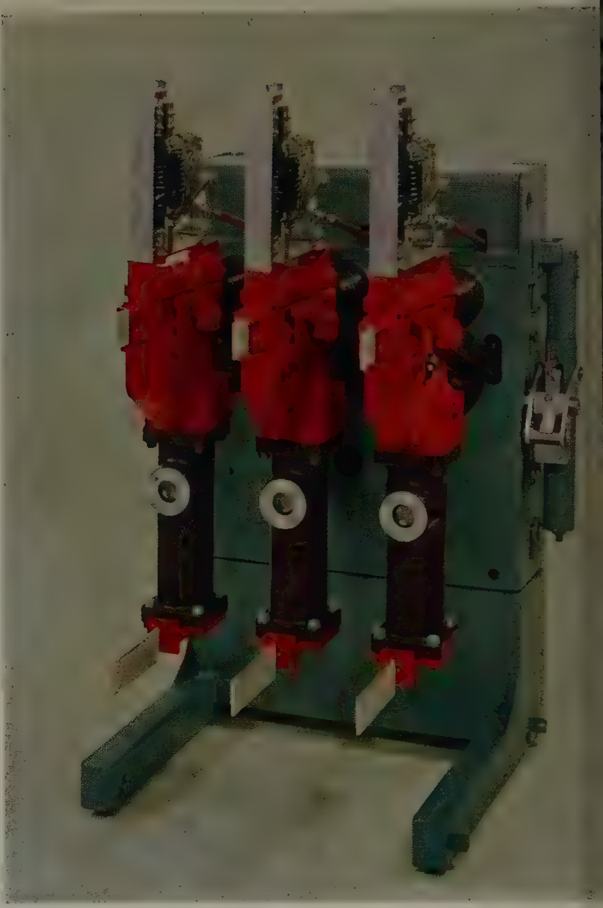


Fig. 4. Oil-minimum circuit-breaker of type HKL 12/400 10/12 kV, 400 A, 150 MVA, with built-on over-curre releases. (F 721)

In the case of small breaking currents, when the pressure in the chamber will be relatively low, the oil injected by the pump towards the shroud of arc gases is of great assistance in the extinction of the arc. This jet of oil also helps to establish very rapidly and effectively the isolating layer in the arc path required to prevent restriking after the extinction.

d) The interruption is completed (Fig. 2d), the difference in pressure in the reactor chamber is fully equalised, and the oil level in the air pocket has been restored to its original position.

APPLICATION

Despite its simple design, the reaction chamber possesses many remarkably good features. Its extinguishing action, which is controlled by the contact plug, is not initiated until the plug has reached a favourable position for the extinction. During this time the necessary pressure is built up in the chamber and is then utilised very effectively for forcing the vapour and oil into channels ideally suited for the arc extinction. The whole operation is carried out extremely rapidly. The arcing time is short, about two half-cycles, the arc length small and t
compressive stresses are consequently reduced to a mi
mum. The latter are also considerably reduced by t
air cushion in the chamber, which makes the chamb
volume flexible.

The most prominent feature of the reaction chamber
its ability to interrupt very high breaking currents
medium voltages. Despite the small dimensions of t
chamber, the interruption takes place without any
markably large compressive stresses occurring. The
action chamber is mainly utilised for the voltage ran
of 3–24 kV in the place of the contraction chamber
some of the Asea oil-minimum circuit-breakers. It h
been possible to increase the breaking capacity of su
circuit-breakers by no less than 50 per cent witho
increasing their dimensions or otherwise making a
radical changes in their design. Figs. 1 and 3 show tw
examples of such circuit-breakers.

The smallest Asea oil-minimum circuit-breaker (ty
HKL, see Fig. 4) is also fitted with the reaction chamb
When designing this circuit-breaker, the aim was
accommodate a 10-kV circuit-breaker with a breaki

pacity of at least 150 MVA in a very limited amount space. The reaction chamber presented the ideal solu-n to the problem.

nother advantageous feature of the reaction chamber that the arc gases are expelled so rapidly after an terruption that the chamber is prepared for the next terruption after a very short interval. In other words, e chamber is ideally suited for high-speed auto-closing.

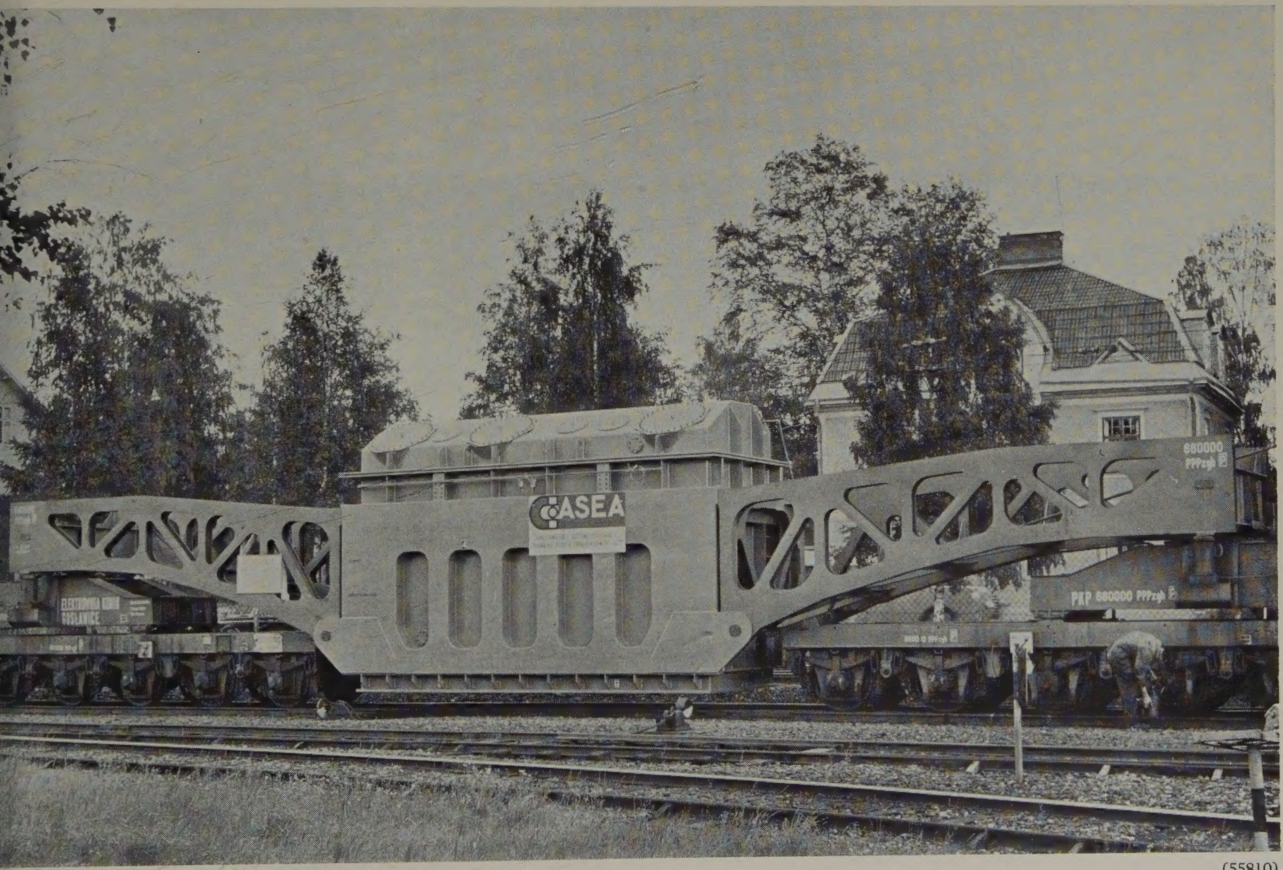
Finally, it should also be pointed out that circuit-breakers incorporating reaction chambers in combination with the oil pumping device in the contact plugs are well suited to interrupt capacitive currents, for example, where shunt capacitors are used. Owing to the risk of switching over-voltages, it is important here that the interruption should preferably be completely restrike-free. As has already been stressed, circuit-breakers of this design possess very favourable characteristics in this respect.

EWS IN BRIEF

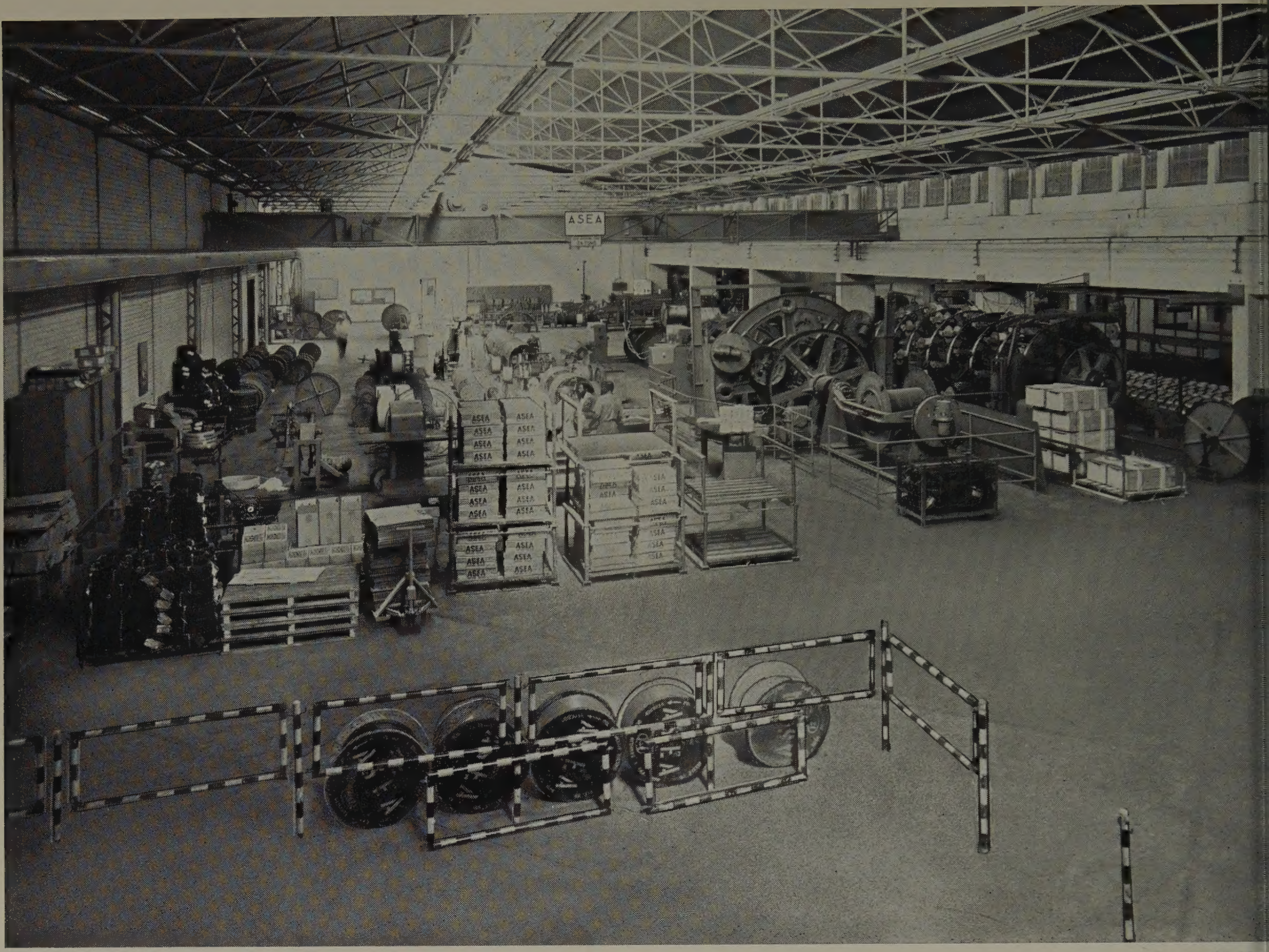
ANSFORMER FOR TRANSPORT ITH A "SCHNABELWAGEN"

ea have recently supplied to Poland three-phase transformer, rated at 60/ /120 MVA, 10.5/10.5/245 ± 2 × 2.5 % , designed for transport with a Po-h "Schnabelwagen". This waggon has o carrying beams ("trunks"), the outer ds of which rest on nine-axle bogies. hen the waggon is not carrying any ad, the other ends of the beams are coupled together. When loading a transformer, the two bogies are drawn apart and the transformer is fixed into position between the beams by means of four bolts, one in each lower corner of the tank. The transformer tank thus constitutes the mechanical coupling for the bogies and is therefore designed to withstand the considerable forces resulting from this arrangement. As can be seen in the photograph, which shows the transformer after it had been loaded at the Ludvika Works, the bushings are removed during transport. The total transport weight of the transformer is 124 tons, and the total distance between the buffers of the bogies amounts to 36 metres (118 feet).

Asea Reg. 471



(55810)



(Z 126

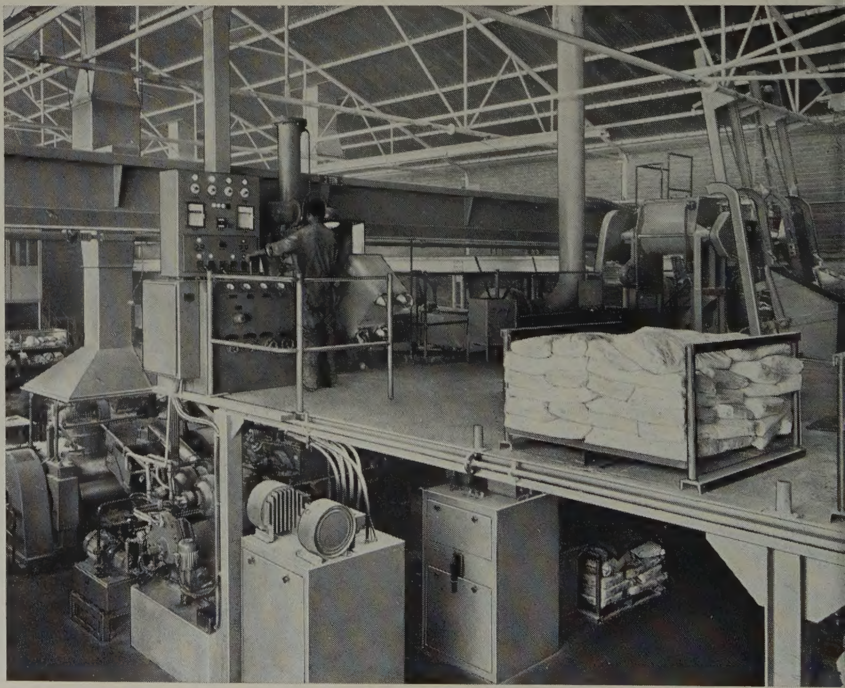
THE ASEA CABLE FACTORY IN SOUTH AFRICA

The manufacturing activities at Asea's South African subsidiary, Asea Electric South Africa (Pty.) Ltd., include cable production. The cable factory, which is situated in Pretoria, the capital of the Republic of South Africa, manufactures a wide range of rubber, and plastic, insulated power cables used by mines, industry and electrical undertakings, as well as certain types of telephone cable.

The upper photograph shows one of the bays of the factory containing machines for laying-up and steel-wire armouring. Some of the extruders for the plastics are visible in the background.

The cable factory is equipped with the most modern plant. The lower photograph shows an internal mixer used for compounding rubbers and plastics.

Asea Reg. 9073



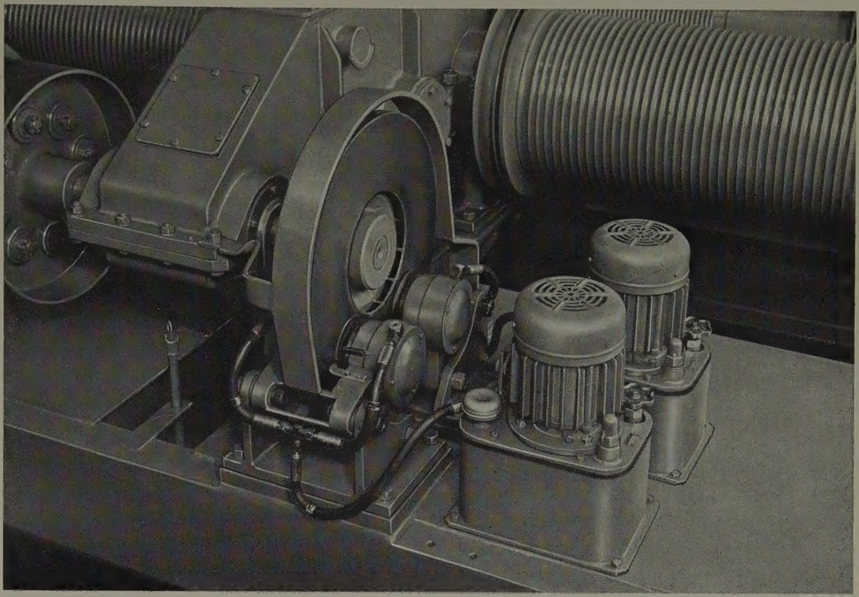
(Z 126

SC BRAKES FOR OVERHEAD ANES

e photograph shows the new Asea
lraulic disc brake, type BSFA/BMPA,
:h two brake units actuating on a
nmon brake disc, installed on an over-
ıd crane crab. One of these brake
its is intended as the working brake
l the other as the emergency brake.
ıce the brake disc has cooling ducts,
l a brake lining of the highest quality
ısed, this type of brake is particularly
table for intense and severe operating
ıditions. Brake application is both
oth and rapid.

e new disc brake, which is also well
ted to many other applications, will
described in greater detail in a com-
number of the Asea Journal.

Asea Reg. 2286

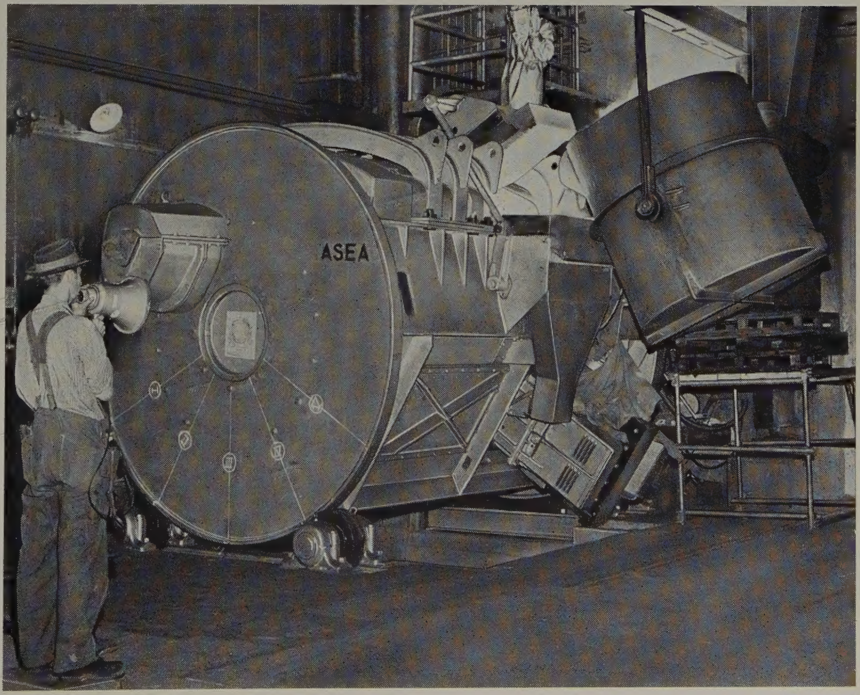


(56303)

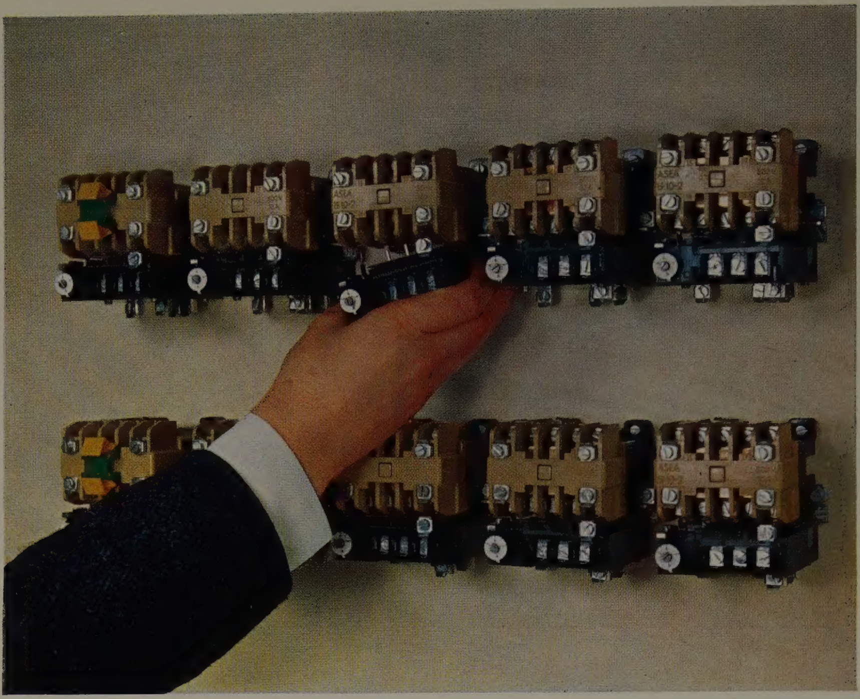
IINS-FREQUENCY INDUCTION RNACE OF CHANNEL TYPE FOR IE HOLDING AND OVERHEATING CAST IRON

15-ton mains-frequency induction fur-
ce has recently been installed in the
ea Foundries at Västerås for the hold-
and overheating of cast iron. This
nace is equipped with three replace-
e inductor units for a total input power
450 kW, and the temperature of the
lt can be raised by means of these
'C per hour when the furnace is fully
ırged (15 tons). There is space avail-
e for yet another inductor unit, which
ans that the furnace input can be
reased to 600 kW. The inductor units
be replaced, if required, without
ring to tap the furnace. This parti-
ar furnace is run as a mixer in con-
ction with two high-frequency furna-
and enables them to be utilised in
nore rational manner. The induction
ting also has a stirring effect on the
lt, thus facilitating the addition of
y elements and the control of the com-
ition. All these factors help to increase
siderably the quality of the cast iron
l, in the final analysis, of the castings
mselves.

Asea Reg. 6642



(Z 11589)



(F 830)

CONTACTOR TYPE EF 10 COMBINED WITH THERMAL OVERLOAD RELAY TYPE RVO

The Asea contactor type EF 10 [see the Asea Journal 33(1960):10–11, pp. 169–172] can now be combined with a new variant of thermal overload relay, which has been given the type designation RVO–2.

The new feature about this combination is that the contact gear for the relay has been improved in that a two-way contact is now available. In this way it is possible to obtain a signal when the relay operates for an overload. The signal indicates that something has happened and that the relay must be reset by hand, which at the same time cancels the signal.

This combination is supplied without any connections between the contactor coil and the relay contact, which makes it possible to arrange the circuits so that the relay will actuate several contactors in, for example, a reversing starter.

A design modification in the relay now enables it to be replaced without having to remove the contactor from its seat, even if the relative lateral distance between adjacent units is only 30 mm (1.2 in.). A relay is moved by loosening the connections and withdrawing the relay downwards and slightly obliquely to the side (see the illustration).

The relay will also be incorporated in other types of direct-on-line starter, such as reversing starters and star-delta switching starters.

Asea Reg. 5576

The Asea Journal is published a
monthly review.

All correspondence should be addr
ed to the Editor, Publicity Dep
ment, Asea, Västerås, Sweden.

Articles or extracts from this Jour
may be reprinted on condition t
the name – Asea Journal – is clea
stated.

ASEA JOURNA

1961 VOLUME 34

CONTENTS

New electric deck crane
by A. Sallow and C.-H. Lindholm

Valve actuators
by G. Lagerblad and A. Jonsson

The reaction chamber – a new breaking feature for high-voltage circuit-breakers
by G. Öhman

News in brief

Transformer for transport with a "Schnabelwagen"

The Asea cable factory in South Africa

Disc brakes for overhead cranes

Mains-frequency induction furnace of channel type for the holding and overheating of cast iron

Contactor type EF 10 combined with thermal overload relay type RVO

Printed in Sweden Västerås 1961
Västra Aros Tryckeri AB